19. The microfluidic substrate assembly of claim 18 in which the multiple plastic layers of the multi-layer laminated substrate are selectively welded one to another to form a fluid-tight seal along a channel within the substrate.

20. A microfluidic substrate assembly comprising a multi-layer laminated substrate defining at least one fluid inlet port and at least one microscale fluid flow channel within the multi-layer substrate in fluid communication with the inlet port for transport of fluid, in which at least one layer of the multi-layer laminated substrate is formed of PEEK.

21. The microfluidic substrate assembly of claim 20 in which the at least one PEEK layer is formed of amorphous PEEK.

22. The microfluidic substrate assembly of claim 20 in which the at least one PEEK layer is formed of crystalline PEEK.

23. The microfluidic substrate assembly of claim 20 in which the at least one PEEK layer comprises IR absorbing species in concentration sufficient for IR welding of the PEEK layer.

24. The microfluidic substrate assembly of claim 23 in which the IR absorbing species is distributed substantially homogeneously throughout the PEEK layer.

25. The microfluidic substrate assembly of claim 23 in which the IR absorbing species is disposed on the surface of the PEEK layer.

26. The microfluidic substrate assembly of claim 25 in which the IR absorbing species is selected from dyes, zinc oxide, silicon oxide and metal species.

27. A microfluidic substrate assembly comprising a multi-layer laminated substrate defining at least one fluid inlet port and at least one microscale fluid flow channel within the multi-layer substrate in fluid communication with the inlet port for transport of fluid, wherein at least first and second layers of the multi-layer laminated substrate are selectively welded to each other to form a fluid-tight seal at least along a channel within the multi-layer laminated substrate.

28. The microfluidic substrate assembly of claim 27 in which the multi-layer laminated substrate further comprises at least one environmentally sensitive structure intolerant to a transition glass temperature of the first and second layers.

29. The microfluidic substrate assembly of claim 28 in which the environmentally sensitive structure is an architectural feature of the microscale fluid flow channel, a mechanical sensor, a mechanical device, an electrical sensor, an electrical device, a fluid, chromatography reagents and any combination of them.

30. The microfluidic substrate assembly of claim 28 in which the environmentally sensitive structure is disposed in the microscale fluid flow channel.

31. A method of producing a multi-layer laminated substrate, comprising the steps of:

forming a surface-to-surface interface by aligning a surface of a first substrate component against a surface of a second substrate component to form a substrate sub-assembly having an internal fluid channel at the interface; and

exposing the sub-assembly to radiation to heat only one or more selected portions of the interface to a temperature sufficient to weld the substrate components together, to form a fluid-tight seal between the substrate components at the interface along the fluid channel.

32. The method of claim 31 further comprising the steps of coating at least a selected area of the surface of the first substrate component with a radiation absorptive material prior to forming the surface-to-surface interface.

33. The method of claim 32 in which the absorptive material is coated onto only one or more selected portions of the surface of the first substrate component and the sub-assembly is exposed non-selectively to IR radiation.

34. The method of claim 32 in which the absorptive material is coated onto the entire surface of the first substrate component and only one or more selected portions of the interface are exposed to IR radiation.

35. The method of claim 34 in which the sub-assembly is exposed to radiation through a mask having a configuration corresponding to the one or more selected portions of the interface.

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